

Telecommunications Systems

GENERAL

Designers shall verify that all applicable portions of these standards are incorporated into the project's design, drawings, specifications and final construction. Requests for variances from these standards shall be submitted in writing to the District's Project Manager

TELECOMMUNICATION SYSTEM DESIGN SERVICES

Consultant-Designed Projects: All projects designed by a consulting architect/engineer, whether a capital project, shall have the telecommunications infrastructure designed by the consultant team (Designer) and installed by the Contractor. This infrastructure shall include all pathways, cabling, terminations, testing and closet construction related to the telecommunications systems. The Designer will provide these services in accordance with these standards, and as directed by the District's department of Information Technology Services (ITS).

Final Provisioning Work for all Projects: ITS will furnish and install the networking equipment and telephone handsets, the selected vendor will be responsible for performing the final wiring cross-connects, and will conduct the final testing of all telecommunication systems installed for the District.

Designers and Contractors shall be required to develop construction schedules that allow adequate time for ITS to inspect the installation and perform equipment provisioning as stated above, prior to the Owner's occupancy of each part of a project. ITS will provide estimates to the Contractor of the amount of time and target dates that will be needed to complete both the Contractor's infrastructure and ITS' work within the overall project construction schedule. Contractors shall be required to cooperate with ITS personnel and allow them equal access to the jobsite to complete their work, concurrent with other work underway by the Contractor.

INTRODUCTION

Communication technologies are a critical element in the design of virtually all new and renovation building projects. Whether it be voice, data and video transmission, security and fire alarm systems, audio/visual systems, or other communication technologies, it is important that a team of experienced professionals are involved in the design of these complex systems.

A Structured Cabling Plant is a key concept in enabling Information Technology for each of the three College communities in the District. In order to maximize network functionality, and to minimize labor and materials cost, a common set of network codes and standards shall be complied with. To accomplish this, the District has adopted a policy in which these codes and standards are managed and administered centrally. The District's ITS Department is charged with this responsibility.

The District is requiring Category 6 cabling to support both voice and data connections. The District's telephone system is based on Voice over IP technology and contractors must have experience with the installation of structured cabling to support both voice over IP and high-performance data networks.

CERTIFICATIONS AND REQUIRED DELIVERABLE ITEMS

- **Telecommunications Contractor Qualifications:** The telecommunications contractor shall provide a minimum of five (5) references for which similar work has been completed by the contractor within the last five years. The contractor shall be fully capable and experienced in the telecommunication system specified.
- **Telecommunications Installer Qualifications:** Telecommunications cable installation and termination personal shall be certified Category 6 and fiber-optic cable installers and shall provide proof of certification.
- **Telecommunication Contractor's Obligations:** The contractor shall furnish and install all material required for a complete system, including installation of communication cables, installation of communication outlets, and termination of all cables in the Service Entrance and Termination Room, Equipment Room, and Telecommunications Room.
 - The contractor shall test and certify all cable installed by the contractor and provide documented results of the testing to SMCCD ITS department. The documented results of the testing must be supplied in both a digital format and printed copy.
 - All Category 6 cable shall be certified according the TIA-EIA 568B Category 6 Standards. If any cable run tests defective, the contractor shall replace defective cable.
 - A five-year materials and labor warranty shall be provided on all cable and hardware installed by the telecommunications contractor.
- **As-Built Drawings and Information:** The Contractor shall prepare and submit record drawings, at an appropriate scale. Contractor shall submit three copies of the drawings on white paper with black print. Approximate size to be 24" x 36". Contractor shall also be required to submit electronic copies on CD-ROM, in AutoCAD Release 2000 format. Items to be included as record drawings and information include the following:
 - Copper feeder cable information to be shown is: cable type, size, gauge, year installed, cable number, pair counts, distance(s) and any and all splice location(s).
 - Fiber feeder cable information to be shown is: type cable, size, cable number, fiber count, distance(s), splice locations, length of piece.
 - Terminal information to be shown is: terminal identity, quantity and type of protectors or unprotected, quantity and type termination blocks, cable and pairs entering and/or leaving.
 - Riser cable information to be shown is: cable type, size, gauge, year installed, length, splice points, cable number, pair count(s).

Architects and contractors have come to accept the rigid industry standards that voice and data communication systems require. For the most part, specialized skill sets that are required for the design and installation of these systems now tend towards commodity status.

However, unlike power cabling systems, the technology of telecommunications cabling continues to advance dramatically. For this reason the District must specify some industry accepted certifications and credentials to guarantee the quality of the installation. Additionally the installed systems must be documented in a way that allows for minimal ongoing labor in the maintenance and management of the installed system.

Codes and Standards: The District's communications systems follow the codes and standards set forth in the ANSI/TIA/EIA Telecommunications Infrastructure Standards. Additionally, the FCC, NESC, NFPA and IEEE and BICSI'S Telecommunications Distribution

Methods Manual is to be used as a reference. In addition the following industry guidelines must be adhered to by the contractor:

- Electronic Industry Association (EIA/TIA) wiring standards for commercial buildings (EIA/TIA 568-B) and Wiring Spaces (EIA/TIA 569).
- EIA/TIA Technical Specification Bulletins for Category 6 wire specifications.
- EIA/TIA Technical specification Bulletins for Category 6 hardware.
- Commercial Building Grounding and Bonding Requirements (TIA/EIA-607).
- Fiber-Optic Inter-repeater Link Standard (FOIRL)
- IEEE 1000Base Fiber-optic Standards
- Underwriters Laboratories
- Title 24 – State of California Code of Regulations
- City or County Electrical Code as applicable
- Occupational Safety and Health Act (OSHA) Standards

The contractor will furnish without extra charge any additional material and labor which may be required for compliance with these laws, rules, and regulations, even though the work is not mentioned in these particular specifications.

Specifications: *These standards include general specification data for the District and are indicative of the "types" of systems that the District requires in all its buildings. These standards are NOT to be used as the final specification or bid document for any specific new construction. It is to be used as a starting point in a process of collaboration between the architect/designer, the occupant, and the District's central telecommunications department of Information Technology Services (ITS). Detailed requirements for the specific project at hand will depend on the unique purpose of the space(s) of that project and shall be supplied during the design phase of the space in that collaboration.*

Contractor is required to adhere to the following parameters whether or not existing equipment has been placed by contractor and/or others. Contractor will notify ITS of any of the following requirements that cannot be met prior to commencement of installation:

- The maximum length of horizontal cabling from nearest closet shall not exceed 295 feet as per EIA/TIA 568B – Category 6 Cabling Standards. Contractor will notify ITS prior to commencement of any installation not meeting the 295-foot maximum distance limitation.
- UTP cabling must conform to a 6 foot separation requirement from main power panels, switch gear and/or starter motors.
- All power feeds crossing the path of the UTP cables at right angles must be a minimum of 12 inches in distance from the UTP cables.
- UTP cables will be installed a minimum of 5 inches from fluorescent lighting.
- The cables shall be placed at a minimum of 18 inches above the ceiling.
- The cables are to be as accessible as possible.
- Backboards must be squarely cut, sanded and painted with two coats of fire retardant paint.
- All conduit installation must meet all local and state building codes.
- Debris, boxes, leftover cables, and trash must be removed from construction sites daily. Area must be left broom clean at the end of each day. No debris or work material may be left in areas that have student access unless the affected area is marked with cones, tape, or temporary fencing.
- Pull conductors together where more than one is being installed in a raceway. Cable bundles in suspension systems or on wallboards must be tie-wrapped every 4 feet. Strapping to any other wire (e.g. lighting ceiling grid, etc.) will not be permitted. Station wire cannot be attached to electrical conduit, gas or sprinkler piping, or other

code-restricted items.

- Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate cable or conduit.
- No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by ITS.
- All cable/cablings shall be kept 30 inches away from any heat source; i.e., steams valves, etc.
- Cables shall be pulled with no sharp bends, kinks, or impact damage to the sheath.
- Cables shall not be pulled across sharp edges. Cables shall not be forced or jammed between metal parts, assemblies, etc.
- Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.
- Insulation shall be removed to expose shielding and conductors to the exact length required by manufacturer for proper termination of plugs and pins and as specified in EIA/TIA 568/569.
- Pins and plugs, upon termination, shall not be damaged in any way.
- All equipment communications racks must be properly anchored to walls and floors and grounded to the building ground grid (not to water pipes, etc.).
- Cable splicing will not be permitted at any point within a cable run.
- Conduits will not be filled to a greater ratio than that specified by the EIA/TIA 569 standards
- Cable mountings on backboards will be installed efficiently, to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed.

Bid Document: It is expected that a result of this collaboration shall be the creation by the Design Team of a bid-quality document that contains commonly accepted and standard language of the industry, such as the Division 16 standard specifications prepared by the Construction Specifications Institute (SpecText) and the American Institute of Architects.

GENERAL OVERVIEW

Listed below are summary descriptions of the separate sub-systems of District's structured cabling system standard, which are then described in detail as separate chapters in this document.

- Service Entrance and Termination Room (MDF):** This is the main telecommunications building service entrance. It is the area where the demarcation between the inter-building and intra-building cabling systems is effected. This securable room is to be dedicated to this purpose with no other building services sharing the space wherever possible.
- Equipment Room (MDF/IDF):** This space provides for the demarcation between inter-building and intra-building telecommunications service. This area contains the electronic equipment that transitions between the core campus data, voice and video backbones and the building backbone. This securable room is to be dedicated to this purpose with no other building services sharing the space wherever possible. This space may be co-located with the Service Entrance and Termination Room, provided the room is sized for both functions.
- Per-Floor Telecommunications Room (IDF):** This room provides for demarcation between the per-floor horizontal customer service cabling and the building data and voice backbone cabling. Additionally this room contains the electronic equipment that transitions between the data and voice building backbone and the end user telecommunications equipment. This securable room is to be dedicated to this purpose

with no other building services sharing the space wherever possible. This space may be co-located with the Service Entrance and Termination Room and/or Equipment Room provided the room is sized for both functions.

- **Communications Conduits:** Communication conduit requirements depart from that for “normal” electrical power distribution. Communications conduit sizing does not follow NEC in terms of the maximum number of conductors allowed per unit volume. Due to the need for facilitating frequent additions, moves and changes to the telecommunication systems, it is required that conduits be generously sized. The following are recommended:
 - Conduits entering the building are usually 4" with some type of sub-space partitioning.
 - Conduits between building telecom rooms are also usually 4".
 - Conduits servicing end user spaces are usually 1".
 - Conduits between floors interconnecting telecom rooms are stubbed 2" into the rooms.

The 1" conduits servicing end users information outlets are usually “stubbed ” to above the ceiling, and then to the nearest corridor/hallway telecommunications horizontal pathway leading to the telecommunications room.

- **Communications Pathways:** Communications pathways are the single most critical component of the structured cable system. At this time, District does not in general require a separate 1" conduit that is homerun from the end user information outlet to the per-floor telecommunications room. In general, the District prefers to utilize wiring hangers (sometimes known as J-Hooks) or cable trays. If however, a path for wire cannot be guaranteed by the architect/contractor, a 1" conduit that is homerun is warranted. A key feature of the j-hook/cable tray arrangement is its theoretical flexibility in ongoing moves, additions, and changes to the cabling system over the lifetime of the building. Any compromise in path assurance leads to end-user frustration when the need arises to provision for a new service.
- **Per-Floor Telecommunications Wiring:** District specifies the latest standard (currently Category 6) in twisted pair wiring. This cable carries the bulk of data and voice services. In general, the District is not requiring fiber to the desktop, though limited instances of this may be required and hence will be specified during the design process. All cable is plenum rated.
- **Building Riser:** The building backbone riser system connects telecommunications rooms to each other, to the main service entrance room and to the equipment room. The District specifies several separate cable systems to provide for the data and voice needs of the building occupants. Riser rated twisted pair copper “bulk” cables, and both single mode and multi-mode fiber along with their termination systems are specified.
- **Grounding and Bonding:** All cabling systems and electronics distribution equipment need to be grounded for both safety and electromagnetic interference reasons. Specifications for this are found in this section.
- **Electrical Power:** Provisioning the electrical power for communications systems requires special attention. Electrical interference as well as power quality must be attended to minimize long term maintenance costs and end user disruptions.

SERVICE ENTRANCE AND TERMINATION ROOM (MDF)

This type of telecommunications room is the required service entrance for telecommunications services (voice and data). The number and size of inter-building conduits to this room will be determined by the number and type of telecommunications terminations that will be brought into the building.

In general, MDF entrance doors should open out to minimize the loss of useable space within the MDF.

The minimum size and number of conduits to a building is two 4" conduits. The location shall be within 50' of the point where the electrical facilities enter the building. Where possible, this room will be dedicated for use by ITS for network support and services. The basic requirements for a Service Entrance and Termination Room are as follows.

- **Required Area:**
 - Minimum area is 6' X 6' for a MDF with less than 100 voice and/or data connections.
 - Minimum area is 6' X 8' for a MDF with 100 – 200 voice and/or data connections.
 - Minimum area is 8' X 10' for a MDF with 200 to 300 voice and/or data connections.
 - Minimum area is 10' X 12' for a MDF with > 300 voice and/or data connections.
- **Height:** Minimum ceiling height is 9' 6", with the bottom of the exposed structure considered the ceiling.
- **Conduits/Sleeves:** Location, number, and size of conduits and sleeves between the Service Entrance and Termination Room, Equipment Rooms, and Telecommunications Rooms will be provided during the design phase of the project. Conduits and sleeves shall extend 4" above floor level or through the wall. For most buildings this will be two 4" conduits between the Service Entrance and Termination Room, Equipment Rooms, and Telecommunications Rooms.
- **Door:** Rooms shall have a fully-opening, lockable door which is at least 36" wide and 80" in height.
- **Interior Finishes:** To minimize dust, floors shall be vinyl composition tile and all exposed concrete, brick and gypsum board walls shall be painted or sealed.
- **HVAC:** Rooms shall have HVAC to control temperature and humidity, unless the facility can maintain the temperature in the room at a range of 65 to 85 degrees with all installed equipment powered on and operating. The specific BTU's of heating and cooling to be provided will be specific to each building. Humidity shall be controlled at 50% +/- 15%.
- **Plumbing:** Service Entrance and Termination rooms should not have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab below the room.
- **Grounding:** Provide a building ground wire, with bus bar, to the room. Locate the bus bar at the lower left corner of the plywood backboard. ITS will indicate on which backboard to place the bus bar. Refer to Grounding section of these standards.
- **Lighting:** Provide minimum lighting to be equivalent of 540 lux (50 footcandles) measured 3 feet AFF.
- **Plywood Backboard Panels:** Each wall that has an equipment rack or cable ladder attached to it, shall have 3/4" X 4' X 8' sheets of A-C Grade, Fire-Retardant-treated plywood installed on them for anchoring termination strips and other devices.
 - The plywood shall reach from corner to corner. Install the plywood vertically at 6" AFF and anchor securely to wall substrate with a minimum of five (5) equally spaced fasteners along each vertical edge and down the centerline of each sheet of plywood.
 - Fasteners shall be of the appropriate type for each substrate. Provide blocking or additional studs in framed walls to receive plywood backup panel fasteners.
 - Paint the plywood with two coats of fire retardant low-gloss, light-colored paint.

- **Electrical:** On each wall, except the wall containing the door, install two A/C 20-amp electrical four-plex outlets, evenly spaced. Refer to Power section of these standards.
- **Floor Loads:** Floors shall be designed to support 100 lbs per square foot at a minimum.
- **Telecommunication Rack(s):** Install an 8' tall and 19" wide telecommunications rack, without panels, to support fiber and cable termination devices and network electronics. Locate the rack in the room so that there is sufficient space to work behind it for installation and maintenance. Fasten the rack to the floor and bond the rack to the ground bus. Location and manufacturer of the rack will be identified by ITS during the design phase of the project. Install an electrical four-plex outlet in the rack to support a UPS which will be located on the floor within the rack. The size of the UPS and type of the receptacle will be determined during the design phase.

Download Example of MDF and Rack Layouts

<http://www.smccd.net/accounts/itwirespecs/img/RackLayouts.pdf>

Download Example of MDF and IDF floor plans

http://www.smccd.net/accounts/itwirespecs/img/mdf_idf_floorplans.pdf

Download Example MDF Rack Layouts

http://www.smccd.net/accounts/itwirespecs/img/MDF_Rack_layouts.pdf

- **Cable Tray:** Install cable tray from the cabinet to the plywood backboard. Bond the cable tray to the ground bus. Location and manufacturer of the cable tray will be identified by ITS during the design phase of the project.
- **Room Size Verification:** When the Service Entrance and Termination Room is also used as an Equipment Room and/or Telecommunications Room, the size of the room shall be sufficient to accommodate the type and number of the services being supplied to the building. ITS will provide the size of the room, based on the type and amount of services required to support the building. ITS will also take into consideration the intended use of the building when determining the size of the Service Entrance and Termination Room.

EQUIPMENT ROOMS (IDF or MDF/IDF)

Equipment Rooms are special purpose rooms that provide space and maintain a suitable operating environment for communications equipment. Equipment Rooms are generally considered to serve a building, where Telecommunications Rooms serve one floor or a section of a floor. The location should be so the room has access to the intra- and inter-backbone pathway and is accessible for delivery of equipment, away from potential sources of EMI, away from machinery that causes vibration, and away from steam pipes, drains, and clean-outs. If the Equipment Room is on a different floor than the Service and Termination Room, it should be stacked above or below the Service Entrance and Termination Room. Wherever possible, the room shall be dedicated to District's ITS Department. The basic requirements for an Equipment Room shall be the same as those previously indicated for the Service Entrance and Termination Room, except as follows.

- **Required Area:** Each Equipment Room shall not be less than the following size, depending on the total number of voice and data connection to be served from the equipment room.
 - Minimum area is 6' X 6' for a MDF with less than 100 voice and/or data connections.
 - Minimum area is 6' X 8' for a MDF with 100 – 200 voice and/or data connections.
 - Minimum area is 8' X 10' for a MDF with 200 to 300 voice and/or data connections.
 - Minimum area is 10' X 12' for a MDF with > 300 voice and/or data connections.
- **Conduits/Sleeves:** Location, number, and size of conduits, and sleeves between the Service Entrance and Termination Room, Equipment Rooms, and Telecommunications Rooms will be specified by ITS during the design phase of the project.
- **Telecommunications Rack(s):** Install a 96" high and 19" wide telecommunications rack, without panels, to support voice and data network terminations and equipment.

Locate the rack(s) in the room so that there is sufficient space to work behind it for installation and maintenance. The amount of services required to support the building may require more than one rack to be installed. Fasten the rack(s) to the floor and bond the rack or cabinet to the ground bus. Number and location of the racks or cabinets will be supplied during the design phase of the project. Install a four-plex electrical outlet in one or more racks to support a UPS to be located on the floor within the rack frame. The size and number of the UPS will be determined during the design phase, along with the size, type and number of electrical receptacles.

PER-FLOOR TELECOMMUNICATIONS ROOM (IDF)

A centrally located Telecommunications Room, not shared with other physical plant systems (or otherwise physically separated from these systems), shall be provided on each floor of the building wherever possible. A Telecommunications Room provides the connection point between the building backbone and horizontal distribution pathways.

The location shall be as close as possible to the center of the floor it is intended to serve. This is to minimize the horizontal cable lengths and duplication of electronic equipment. The basic requirements for a Telecommunications Room shall be the same as those previously indicated for the Service Entrance and Termination Room, except as follows.

- **Room Locations & Spacing:** Maximum distance between the Telecommunications Room on each floor and a telecommunications outlet is 295 feet, as measured per the cable pathway.
 - There shall be at least one Telecommunications Room per floor.
 - The Telecommunications Room shall have a means to access the per-floor wiring pathways.
 - The Telecommunications Rooms should be stacked above each other on the different floors. If rooms are not stacked, the Telecommunications Room shall have a means to access the Telecommunications Rooms on the floor above and below via metal conduits or sleeves.
- **Room Area:** Each Telecommunications Room shall not be less than the following size, depending on the total number of voice and/or data connections being supported.
 - Minimum area required for < 100 voice and/or data connections is 4' X 4'
 - Minimum area required for 100 to 200 voice and/or data connections is 6' X 8'
 - Minimum area required for 200 to 300 voice and/or data connections is 8' X 10'
 - Minimum area required for > 300 voice and/or data connections is 10' X 12'
- **Conduits:** Two 4" conduits shall be installed between Telecommunications Rooms located on different floors. One 3" conduit shall be installed between Telecommunication Rooms located on the same floor. Location of conduits, cable trays, and sleeves shall be coordinated with ITS staff. Conduits and sleeves shall extend 2" above floor level or through the wall.
- **Electrical:** On each wall, except the wall containing the door, install two A/C 20-amp electrical four-plex outlets. In the larger rooms, 8' X 10' and larger, install three A/C 20 amp electrical four-plex outlets evenly spaced along each wall.
- **Floor Loads:** Floors shall be designed to support 2.4 kPA (50 lb'/ft²) minimum.
- **Telecommunication Rack(s) and UPS Outlet:** Provide the same as the Equipment Rooms.
- **Smoke & Fire Sensors:** Each Telecommunications Room shall contain a smoke/fire sensor as part of the overall building fire alarm system.
- **Cable Management:** The ethernet cables will be terminated in the rack in patch panels with cable management. The specific part numbers of the patch panels and cable management devices are specified in this document.

COMMUNICATIONS CONDUITS AND INFORMATION OUTLETS

The minimum conduit and outlet specifications for District's communication cabling system are as follows:

- **Communication Entrance Conduits:** The communication entrance conduit shall consist of at least two (2) four inch (4") conduits run from the nearest existing manhole or pull-box, to the Service Entrance and Termination Room of the new facility.
 - This run of conduit shall not contain more than two 90-degree bends and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts.
 - No run of conduit shall exceed 300 feet between pull-boxes or manholes.
 - New manholes shall contain permanent ladders, pull rings, grounding system, a sump pit, and a floor drainage system to drain water.
 - New pull-boxes shall contain, pull rings, grounding system, a sump pit, and a floor drainage system to drain water.
- **Other Outdoor Communication Conduits:** Conduit run outdoors for other communication purposes shall be a minimum of one-inch diameter, and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts.
 - No run of conduit shall exceed 300 feet between pull points and contain no more than two 90-degree bends.
 - If pull-boxes are installed the conduits shall enter the pull-box one foot above the bottom and the pull box shall have a means to drain water from them.
- **Service Entrance:** The conduits entering from outside of the building shall terminate 4 inches after they penetrate the outside wall. Cable tray shall be installed from the penetration point to the Service Entrance and Termination Room. A ground wire with buss bar shall be installed at the location the cable enters the building.
- **Voice and/or Data Connections:** At least two Cat. 6 outlet boxes with a minimum of two Cat. 6 cables per box shall be installed on opposite walls within every classroom. There shall be two outlet boxes containing three Category 6 jacks in each office unless otherwise designated by ITS. Boxes should be installed on opposite walls.
- **Conduit from Outlets:** A one-inch conduit shall connect the four jack Category 6 outlet box to the nearest cable tray or J-hook. The conduit shall terminate within 4 inches of the nearest cable tray or J-hook. The minimum size conduit run from the telecommunication outlet to the nearest cable tray or J-hook shall be a one-inch EMT conduit.
- **Conference Rooms:** One outlet box with four Category 6 jacks and the corresponding one-inch conduit shall be installed in every conference room and be connected directly to the Telecommunication Room on that floor as designated by ITS.
- **Security & Fire Alarm Telecommunication Conduits:** Conduit installed for Security and Fire Alarm shall be a 1" EMT conduit and be a home run back to the Telecommunications Room and shall have a pull box after every 180-degree change in direction or elevation or every 150 feet.
 - Conduit runs shall not exceed 295 feet in length.
 - Provide pull boxes in readily accessible locations. The installation of pull boxes in the conduit run shall be placed in line with the conduit run such that wire or fiber-optic cable can be pulled through the pull box without incurring damage to the cable. No turns or bends of the conduit run are allowed with pull boxes.
- **Public Telephones:** Conduit installed for payphones, emergency phones and elevator phones shall be a 3/4" EMT conduit and be a home run back to the Telecommunications Room and shall have a pull box after every 90 degree change in direction or elevation or every 150 feet.
 - Conduit runs shall not exceed 295 feet in length.
 - Provide pull boxes in readily accessible locations. The installation of pull boxes in the

conduit run shall be placed in line with the conduit run such that wire or fiber-optic cable can be pulled through the pull box without incurring damage to the cable. No turns or bends of the conduit run are allowed with pull boxes.

- **Bending Restrictions:** Minimum radius for bends shall be 9-1/2 inches for 3/4-inch conduit, 10-1/2 inches for one inch conduit and the equivalent of long radius factory bends for larger sizes. The short radius bends of larger diameter conduit normally installed for electrical installations is not sufficient for communication cabling. Four (4) inch conduit installed for communication cabling shall have a four foot radius bend.
- **Labeling:** The contractor is expected to provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels must be of high quality that will endure over time. Hand written labels are not acceptable. The contractor is required to provide labels for all station cable at ten inches of the termination ends, using Brady type self-laminating cable markers or equal. Station cables will be labeled on both ends with the wall plate numbers according to the ITS labeling standards. Label all pull and junction boxes consistent with ITS standards and naming conventions.
- **Pull Cords:** Provide a nylon pull cord in each empty conduit with a 200 pound pulling tension.
- **Fiber-optic Cabling:** Conduit installation for communication purposes shall be installed with the probability of fiber-optic cable being installed in it and pulling tension and minimum bend radius being critical factors for installing usable fiber-optic cable as well as the Category 6 cable.

COMMUNICATIONS PATHWAYS SPECIFICATIONS

The standards adopted by the District provide that a clear and accessible pathway for horizontal telecommunications cabling be provided. These pathways are located between the Telecommunications Rooms and the rooms/offices containing the voice and/or data outlets. The Design Team consultants shall prepare drawings and specifications that insure a clear and accessible pathway for telecommunications wiring. Any pathway that is not accessible or does not provide a clear and workable pathway will need to be removed and reinstalled to provide a clear and accessible pathway.

There are several methods available for providing a pathway for supporting telecommunications cables. The architectural design of each building is unique and requires an analysis of which method(s) are best suited for that building. J-Hooks are the preferred method of providing a pathway. Cable trays may be used and in many instances may be preferred. Each type is listed below.

- **Cable Trays:** The cable tray size(s) will be determined during the design phase of the project. The cable tray shall be installed in accordance with the applicable electrical code. The cable tray is to be dedicated for use only by ITS. No other cabling is to share the cable tray without the approval of ITS. There are three manufacturers recommended for cable trays as shown below, however, an equivalent quality cable tray can be substituted:
 - MONO-Systems, Inc., "MONO-Tray" system
 - B-Line Systems Inc., "Cent-R-Rail" system
 - Chatsworth, "Cable Runway system"
- **J-Hooks:** The model to use will be determined by the number of cables in that pathway. No other cabling is to share the J-Hooks with ITS. There are two manufacturers recommended for J-hooks, however, an equivalent quality J-hook can be substituted:
 - B-Line Systems, Inc.; Models BCH21, BCH32, and BCH64
 - Erico Fastening Products, "CableCat" system; Models Cat21 and Cat32

PER-FLOOR TELECOMMUNICATIONS WIRING SYSTEMS

Installation and physical protection of Category 6 cable is a very critical element for the cable to deliver its rated bandwidth. Any kinks, pinches, a bend radius less than 1.25 inches in diameter, or stretching of the cable by exceeding the 25 pound maximum pulling tension during installation will damage the cable to the point that it will not meet rated specifications and must be replaced.

Requirements for terminating of Category 6 cable require no more than the minimum amount of the common sheath be removed than is required for termination and no more than 1/2 inch of untwisting of conductors. Installation personnel shall be BICSI certified installers or equivalent and provide proof of certification.

The minimum wiring system specifications are described below. **Please note that Category 5 or Category 5e is NOT acceptable.**

- **Typical Office Configuration:** Each office will be configured to include at least two boxes with a minimum of three Category 6 cables. The boxes are ideally located on opposing walls. However, for each project the Design Team in consultation with ITS will make the determination of the exact cabling configuration for each room.
- **Typical Lecture Classroom Configuration:** A typical classroom that is used for lecture will be configured to include at least four Category 6 jacks to support voice and/or data. However, for each project the Design Team in consultation with ITS will make the determination of the exact cabling configuration for each room.
- **Cables:** Category 6 cable is required and will consist of twisted pair, 100 Ohm cable which has transmission capabilities up to 250 MHz, and is ETL verified to TIA/EIA-568-B.2 Category 6 specifications. Category 6 cable will be used for both horizontal and backbone cable. It will have two insulated conductors twisted together to form a pair and four pairs laid up to form the basic unit. Horizontal cable shall also meet the requirements of clauses 4.3.3.1 to 4.3.3.6 of ANSI/TIA/EIA-568-B.2. Backbone cable shall meet the requirements of clauses 4.4.3.1 to 4.4.3.6 of ANSI/TIA/EIA-568-B.2.
- **Cabling Specification:** The preferred type of communication cable shall be verified with ITS during the design phase of each project. However, Berk-Tek Landmark 1000 plenum rated cable is recommended. (Updated 2/8/05)
- **Connecting Hardware and Cords:** Connecting hardware and cords must also be Category 6 certified and meet the requirements of clauses 6.1 through 6.3 of ANSI/TIA/EIA-568-B.2 and clause 7.2.1.3 and 7.4.4 of the original standards documentation
- **Cabling Runs:** The cable run from the Telecommunications Room to the telecommunications outlet, consisting of at least two cables, shall not exceed 295 feet and contain no splices. These cables are to provide service for both voice and data communications as an integrated telecommunications system.
- **Cable Ends:** At the user end of the cables, in the outlet box, there shall be 12 inches of slack after termination to facilitate future re-terminations. At the Telecommunications Room the wire shall reach the punch down patch panel and have 3 feet of slack. Cable shall be routed so the 3 feet of slack is managed in a neat bundle and not coiled.
- **Labeling:** The contractor is expected to provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels must be of high quality that will endure over time. Hand written labels are not acceptable. The contractor is required to provide labels for all station cable at ten inches of the termination ends, using Brady type self-laminating cable markers or equal. Station cables will be labeled on both ends with the wall plate numbers according to the ITS labeling standards for cabling systems.

ITS Labeling Convention

MDF/IDF rooms are to be designated TD(A-E). The first floor equipment room is to be identified as TDA. Additional MDF/IDFs are to follow alphabetically.

Each data/phone Cat. 6 cable in each building is to have a unique number beginning with the number 1. The cable is to be labeled at both ends with the TD letter identifier and the cable number. An example of a cable label would be TDB 103. The TDB designates the B equipment room and the 103 is the unique cable number.

The patch panel and racks are to be labeled with the unique cable number.

The room faceplates are to be labeled with the TDA at the top of the faceplate and each jack with the unique cable number.

Download example

http://www.smccd.net/accounts/itwirespecs/img/typ_data_voice_outlet.pdf

- **Clearances:** The installation of these data and voice cables shall conform to the following clearances:
 - At least 127 millimeters (5 inches) from power lines carrying 2KVA or less
 - At least 305 millimeters (12 inches) from power lines carrying from 2 to 5KVA
 - At least 915 millimeters (36 inches) from power lines carrying more than 5KVA
 - At least 127 millimeters (5 inches) from all fluorescent lights and other sources of electromagnetic interference such as electric motors, HVAC equipment, arc welders, intercoms, etc.
- **Category 6 Parts:** The following list is the recommended Category 6 specifications for required components and parts. All specifications are for Panduit parts and are the current ITS network standards.
 - Patch Panels Mini-Com Modular 24 Port, Panduit Part #CPP24WBL
 - Mini-Jack Category 6, 8-wire RJ-45 Universal 568 A/B, Orange in color, Panduit Part #CJ688TOR For use with Patch Panels , Faceplates and surface mount box's
 - Surface Mount Boxes 2 Module, Off White in color, Panduit Part #CBXJ2IW-A
 - Surface Mount Boxes 4 Module, Off White in color, Panduit Part #CBXJ4IW-A
 - Mini-Mod Blanks for Unused spaces in Faceplates and Surface Mount Boxes, Panduit Part #CMBIW-X
 - Faceplates, 2 Module Space, Single Gang, Off White, Panduit Part #CFPE2IW
 - Faceplates, 4 Module Space, Single Gang, Off White, Panduit Part #CFPE4IW
 - Faceplates, 6 Module Space, Single Gang, Off White, Panduit Part #CFPE6IW
 - High-density rack mount panel kit. GP6™ PLUS Category 6 High Density Rack Mount Panel Kits; Panduit Part # GPB2884R4WJ
- **Faceplate Labeling:** A printed label will be placed on the faceplate of each telecommunication outlet according to the ITS labeling standards.
- **Exposed Wiring & Conduits:** No open or exposed wiring or conduits will be permitted below finished ceilings. Ivory colored surface raceway, Wiremold 2100 with a 2144-2 box (or equivalent) can be used in places where "fishing" of walls is not possible.
- **Testing:** Each basic link shall be tested and certified to according to Category 6 standard and all industry standard test data recorded and **supplied to ITS in a digital format**. The transmission parameters to be tested are based on the TIA-EIA 568B Standards for Category 6 cabling. For each transmission parameter where applicable, the cable, connecting hardware and cords shall be tested for the parameter under the following categories:
 - Individual test parameter for cable
 - Individual test parameter for connecting hardware
 - Permanent Link
 - Channel
 - Work Area Cords, Patch Cords and Equipment Cords

More information about the current standard can be found at:

http://cablingdb.com/Standards/568B/TIA-EIA-B2-1_Cable_Specifications.asp

The transmission parameters to be tested to meet Category 6 standards include:

- Insertion Loss
- Near End Cross Talk (NEXT) and Power Sum Near End Cross Talk (PSNEXT) Loss
- Cabling Pair-to-Pair Channel and Permanent Link NEXT loss
- Cable Power Sum NEXT Loss
- Work Area, Equipment, and Patch Cord Pair-to-Pair NEXT Loss
- FEXT and ELFEXT Loss
- Connecting Hardware Pair-to-Pair FEXT Loss
- Permanent Link and Channel Pair-to-Pair ELFEXT
- Power Sum ELFEXT (PSELFEXT)
- Cable Power Sum ELFEXT
- Permanent Link and Channel Power Sum ELFEXT
- Return Loss
- Horizontal Cable Return Loss
- Stranded Conductor Cable Return Loss
- Connecting Hardware Return Loss
- Work Area, Equipment, and Patch Cord Return Loss
- Permanent Link and Channel Return Loss
- Propagation Delay and Delay Skew
- Cable Propagation Delay
- Permanent Link and Channel Propagation Delay
- Cable Propagation Delay Skew
- Permanent Link and Channel Propagation Delay Skew
- Balance
- Cable and Connecting Hardware LCL
- Longitudinal Conversion Transfer Loss (LCTL)

BUILDING RISER SPECIFICATIONS

A twisted pair riser cable and a fiber-optic riser (in inner-duct) shall be installed from the Service Entrance and Termination room to each Telecommunications Room and the Equipment Room:

The minimum specifications for this riser system are as follows:

- **Copper Cable Riser:** A minimum quantity, to be specified by ITS, Category 6 riser cable shall be installed from the Service Entrance and Termination Room to each Telecommunication Room.
- **Copper Cable Testing & Records:** The cable installer will provide three (3) sets of each test record report to ITS. The following electrical tests records shall be provided by the contractor on all feeder copper cables:
 - Continuity test on all pairs, (test for opens)
 - Test for crosses and shorts, on all pairs
 - Test for loss at 1004hz, on all pairs
 - Test for noise metallic and noise to ground, sampling can be used
 - Test for insulation resistance, sampling can be used
- **Fiber-optic Cable Riser:** A minimum fiber-optic riser consisting of 6 strands of 50/125 micron multi-mode and 6 strands single-mode cable(s) will be installed from the Service Entrance and Termination Room to each Telecommunications Room.
 - The fiber-optic riser cables shall be terminated at the Service Entrance and

- Termination Room in LIU's installed in the corresponding rack.
- The multimode and single mode fibers shall be terminated in different LIU's.
- In each Telecommunications Room two wall-mounted LIU's shall be installed, one for each type of fiber.
- Terminate the fibers as follows:
 - Single Mode Fiber, Simplex SC (Blue)
 - Multimode 62.5 micron (legacy fiber), Duplex SC (Beige)
 - Multimode 50 micron, Duplex LC (beige)
- There shall be 15 feet of slack looped in the LIU to facilitate future re-terminations.
- **Acceptable Materials and Parts for Fiber-optic Cabling:**
 - Building to building interconnections will require 12 strands of single-mode and 12 strands of 50/125 micron multi-mode fiber to be installed. All underground cable that is installed in conduit must be waterproof, and any standard cable must be installed in inner duct. However, armored fiber-optic cable does not require inner duct. All part numbers provided below are from Corning Products. It is acceptable to use a composite type fiber-optic cable when available.
 - 50/125 micron fiber:
 - Standard, Corning Part #012CS4-14131A20
 - Armored, Corning Part #012CW5-14150A20
 - Single Mode:
 - Standard, Corning Part #012RS4-14101A20
 - Armored, Corning Part #012RW5-14101A20
 - Interior Fiber (6 strands each of single-mode and 50/125 micron multimode fiber) for installation between floors within buildings - All part numbers are non-plenum and should be changed as needed based on required building and other construction or electrical codes.
 - 50/125 micron fiber:
 - Standard, Corning Part #006C81-31131-24
 - Armored, Corning Part #006C81-31131A1
 - Single Mode fiber:
 - Standard, Corning Part #006R81-31131-24
 - Armored, Corning Part #006R81-31131A1
 - Rack Mount Termination with SC type connectors, Corning Part #CCH-01U or larger if required
 - Wall Mount Termination with SC type connectors, Corning Part #WCH-02P or larger if required
 - Cable Trays - Cabofil Inc., EZTray, or Chatsworth or equivalent
- **Fiber-optic Cable Testing:** For fiber-optic cables, the test shall be in accordance with the following outline:
 - End to end dB loss, both directions, at 850 and 1300 for multimode and 1310 and 1550 nanometers for single-mode.
 - Distance in feet for actual cable length
 - Distance in Kilometers for actual cable length
 - Type of fiber used
 - Number of splices in each fiber
 - Building name
 - Cable number
 - Cable count
 - Maximum allowable loss for splices is .3dB
 - Maximum allowable loss for connectors is .75dB per pair

GROUNDING AND LIGHTNING PROTECTION

Each Service Entrance and Termination Room, Equipment Room and the Telecommunications Room shall have a bus bar installed and bonded to ground as per the requirements of Telecommunications Industry Association standard ANSI/TIA/EIA-607

Grounding and Bonding Standard are as follows:

- Ground Wires to other Telecommunication Rooms/Closets:** An insulated copper ground wire shall be run from the Service Entrance and Termination Room bus bar to the Equipment Room bus bar and the ground bus bar in each Telecommunications Room. This ground wire shall be sized based on the cable size of the main electrical feed.
- Multiple Risers:** If there is more than one closet riser in a building, each closet riser shall have the same ground system installed as stated in the previous paragraph.
- Ground Bus:** The ground bus for the Service Entrance and Termination Room, Equipment Room, and each Telecommunications Room shall be a SQUARE D GROUND BAR KIT Cat. #PK23GTA or equivalent. If this ground conductor passes through metal conduit or metal enclosures greater than three feet in length, each end of the conduit or enclosure shall be bonded to the ground conductor by approved means.
- Grounding Plan:** Each grounding plan shall be tested using a Two-Point Test Method, and the ohmic value shall be less than 0.1 ohm to be considered to have an adequate bonding between the two reference points.

POWER

The standard electrical outlet is a four-plex electrical outlet. The circuit shall be a dedicated 20 amp circuit, surge protected, with no shared neutral.